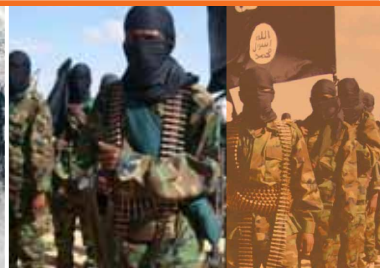




Concerning the Impact of **CLIMATE CHANGE** ON INDIA'S SECURITY

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VICE ADMIRAL (RETD.) PRADEEP CHAUHAN, Director, National Maritime Foundation & Adviser, Ananta Aspen Centre is an alumnus of India's National Defence Academy, Defence Services Staff College, College of Naval Warfare and the National Defence College, Vice Admiral Pradeep Chauhan retired in December 2013 after an extremely distinguished four-decade-long career in the Indian Navy. His extensive command and staff experience at sea and ashore has honed his critical-thinking to a fine edge at the strategic, operational and tactical levels. Admiral Chauhan has been twice commended by the Chief of the Naval Staff and three times by the President of India for sustained distinguished service of an exceptional order.

A respected and widely-read author, he has had numerous articles and papers published in a variety of magazines and professional journals in India and abroad. He is also a leadership-mentor, a powerful motivator and an incisive analyst — all of considerable repute.

Abstract

IT IS AN INCONTROVERTIBLE FACT that adding energy to the Earth system will warm it up, raising temperatures, melting ice, and raising sea levels. What is not known is how fast or how far the climate will warm. Consequently the multitude of associated changes that will take place cannot be accurately predicted. That said, global scientific consensus does exist on five ‘climate certainties’ that are in abundant evidence:

1. Enhanced emission of Green House Gases
2. Higher surface, tropospheric, and ocean temperatures
3. More precipitation — and drought — extremes
4. Melting of mountain glaciers, Arctic sea ice, and ice sheets
5. Rising sea levels.

This monograph explores the various impacts of these climate certainties upon maritime security.



CONCERNING THE IMPACT OF CLIMATE CHANGE ON INDIA'S SECURITY

Concerning the Impact of CLIMATE CHANGE ON INDIA'S SECURITY

—Vice Admiral Pradeep Chauhan, AVSM & Bar, VSM, IN (Retd)

INDIA'S HOLISTIC-SECURITY IS A FUNCTION of two main features. The first comprises the policies, strategies, organisational-structures and the delivery-mechanisms that guide and shape her internal politics and determine her internal stability as a coherent geopolitical entity. The second feature consists of elements that define and shape India's interaction and interface with external structures — supranational and international organisations, nation-states, and, non-State entities, any of which may, at given points in time, be either supportive or inimical to India's own geopolitical endeavours. These two features have numerous causal linkages with each other and the infirmities as well the strengths of one significantly impact the other. While considering India's geopolitics, it is a major conceptual error to place geopolitics, geoeconomics and geostrategy and the same hierarchical level.

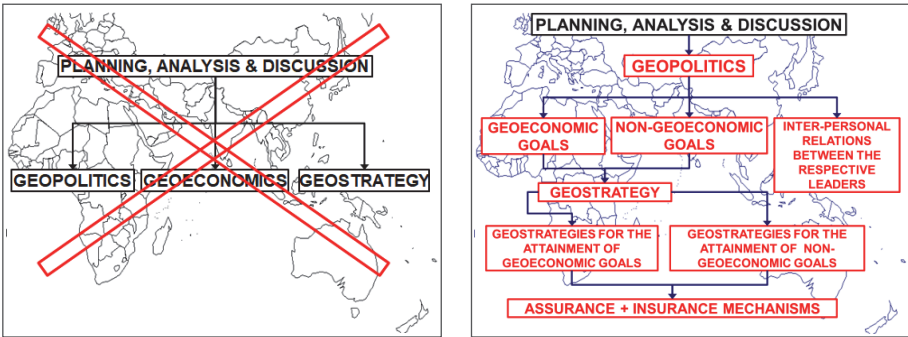


Figure: 1

Figure 1 offers a cogent depiction of the wrong and the right formulation of these. It should be noted that militaries and their logistic-support structures (e.g., overseas bases) are major components of ‘assurance and insurance mechanisms’.

Moving on from the traditional view of security being limited to military security alone, the Government of India, in common with those of most other nation-states, has adopted a far more holistic approach to maritime security, defined as freedom from threats arising in- or –from- or –through the sea.¹ These threats could arise from natural causes or from manmade ones, or from the interplay of one with the other, as exemplified by environmental degradation and global warming. Insofar as the *targets* of such threats (arising from a lack of maritime security) are concerned, these could be individuals themselves—or ‘groupings’ of individuals, such as societies and/or nation-states. When these threats address the regional fabric itself, nation-states find themselves increasingly enmeshed in a complex web of security interdependence, which tends to be regionally focused and a robust regional initiative ought to be a logical outcome of this regional focus. While *military* maritime security does, of course, continue to enjoy primacy, it is now firmly established within a new construct that incorporates military, political, economic societal and environmental dimensions of security. Each of these dimensions of security is linked to the other by a complex web of

1 Address by Dr Manmohan Singh, erstwhile Prime Minister of India, inaugurating the Indian Ocean Naval Symposium (IONS) Seminar at New Delhi, 14 February, 2008. <http://archive.pmo.nic.in/drmanmohansingh/speech-details.php?nodeid=633>

causal relationships and none of them can be adequately addressed in isolation from the others. Thus, threats to human-security, such as religious extremism; international terrorism; drug and arms smuggling; demographic shifts — whether caused by migration or by other factors; human trafficking; environmental degradation; energy, food and water shortages; all now figure prominently as threats that are inseparable from military ones. Of all these threats to human security, the adverse impacts of climate change is perhaps the most ubiquitous. Ironically, despite their utter pervasiveness across both space and time, the security-impacts of climate change are amongst the least studied in nation-states such as India. Consequently, genuine mitigating and/or coping strategies are either absent in their entirety, or are hopelessly inadequate.

The casual — almost nonchalant — approach presently obtaining in India is made worse by the scepticism that has, in recent times, been emanating from the apex levels of the current US administration. The abundance of scientifically proven evidence notwithstanding, President Donald Trump has made his feelings — that climate change is a hoax — known to the world in no uncertain terms. In the run-up to his election, one of the most astonishing statements made (tweeted) by him was that *“The concept of global warming was created by and for the Chinese in order to make U.S. manufacturing non-competitive.”*² However, as John Adams famously said way back in 1770, *“Facts are stubborn things; and whatever may be our wishes, our inclinations, or the dictates of our passions, they cannot alter the state of facts and evidence.”*³ In more contemporary times and within the context of climate change, Professor Mark McCaughrean, the Senior Advisor for Science and Exploration at the European Space Agency, quite correctly asserts that *“The laws of physics are going to continue heating up the planet in response to increased levels of CO₂ whether we’d like them to or not. Whether we deny them or not.”*⁴

2 Donald Trump's Tweet at 12:45 AM on 07 November 2012. Quartz Digital News Outlet, New York, USA. <https://qz.com/948182/scary-and-laughing-at-us-donald-trumps-thinking-on-china-is-remarkably-consistent-across-five-years-and-more-than-300-tweets/>

3 Adams' Argument for the Defense: 3–4 December 1770. Adams Papers, The National Archives and Records Administration, Maryland, USA. <https://founders.archives.gov/documents/Adams/05-03-02-0001-0004-0016>

4 Mark McCaughrean, Opinion Piece in Al Jazeera online edition, 02 Feb 2017 <http://www.aljazeera.com/indepth/opinion/2017/01/science-climate-change-170127115338110.html>

Summed up even more pithily in numerous tweets on Twitter, climate change doesn't care whether you believe in it or not. And yet, on 01 June 2017, President Trump announced that he would be pulling the USA out of the Paris Agreement, despite the fact that the USA has both, signed and ratified it. He stated that *"as of today, the United States will cease all implementation of the non-binding Paris Accord ...this includes ending the implementation of the nationally determined contribution."* However, although Article 28 of the Agreement, which came into force on 04 November 2016, permits a Party to withdraw by giving written notification to the Secretary-General of the United Nations, it specifies that such a notification may only be provided *"after three years from the date on which [the Paris Agreement] entered into force for a Party."* Withdrawal then takes effect upon expiry of one year from the date of receipt.⁵ Therefore, the earliest that the USA could leave the Paris Agreement is 04 November 2020, one day after the next (59th) presidential election of 2020. Until that date, the USA is obliged under international law not to frustrate or obstruct the implementation of the Agreement. Given the proximity of this date to the next presidential election in the USA, the final shape of things remains unclear. What is, however, clear is that in the final analysis, disagreements in respect of climate change (including India's own arguments prior to the Paris Agreement including the declaration made while signing it) are actually about ethics, reflecting the extent to which we should feel obligations towards future generations. When nations discard or discount the risks of climate change beyond 2050, for whatever reason (including the arguments that aver that the greatest polluters must pay the most) they are actually discounting their ethical obligations to future generations of humankind. They therefore conclude that tackling climate change should be given a low priority compared to other public policy aims. However, babies born today — even as a reader reads this monograph — are quite likely to live until 2100 (after all they will only be 82 years old). Their children are almost certain to do so. So the question really boils down to whether or not this (or that) government actually cares about those generations and whether governments — including those of India — deem it worth making an

5 Potsdam Research Institute. <https://www.pik-potsdam.de/primap-live/entry-into-force/>

investment in the ‘here and now’ in order to provide security to future generations of Indians to keep them safe from at least the ‘worst-case scenarios’ relating to climate change.

These political shenanigans do not, however, take away from either the centrality or the pervasiveness of climate change as a determinant of holistic security (or the lack of it). The facts of the matter have been pithily enunciated in a July 2015 report of the Centre for Science and Policy (CSaP), University of Cambridge:⁶

- A remarkable degree of climatic stability, with minimal variations of global temperatures and sea levels, has characterised the 10,000 years or so since human civilisation emerged. This climatic stability has enabled us humans to grow crops, build cities and develop a global economy. **This period is now ending.**
- Since the Industrial Revolution, we have been accelerating into what is known as the ‘Anthropocene’ — the period in which human activities have a very significant global impact on the Earth’s ecosystems. Human activities are trapping heat and adding energy to the Earth’s system equal to the energy of four nuclear bombs of the size dropped on Hiroshima and Nagasaki, every second!
- Small changes in global temperature produce large changes in the global climate. If the global temperature were 5° C cooler, we would be in an ice age last experienced some 10,000 years ago. 5° C warmer and we would be in a climate of heat last experienced by the planet over 10 million years ago, long before the beginning of human existence.

It is an incontrovertible fact that adding energy to the Earth system will warm it up, raising temperatures, melting ice, and raising sea levels. What is not known is just how fast or how much the planet will warm. Consequently the multitude of associated changes that will take place cannot be accurately predicted. That said, global scientific consensus does exist on five ‘climate certainties’ that are in

⁶ *Sir David King, Arunabha Ghosh, Prof. Daniel Schrag, Prof. Zhou Dadi, Prof. Qi Ye. “Climate Change: A Risk Assessment”, Centre for Science and Policy, Cambridge University. <http://www.csap.cam.ac.uk/projects/climate-change-risk-assessment/>*

abundant evidence:

1. Enhanced emission of Green House Gases (GHG).
2. Higher surface, tropospheric, and ocean temperatures.
3. More precipitation — and drought — extremes.
4. Melting of mountain glaciers, Arctic sea ice, and ice sheets.
5. Rising sea levels.

This monograph explores the various impacts of these climate certainties upon maritime security.

The first of them is an overarching one, for it directly contributes to the remaining four. As long as CO₂ emissions continue (even if they do not accelerate any further), the build-up will continue. Rising atmospheric CO₂ concentrations mean rising temperatures. As per the World Meteorological Organisation (WMO), 16 of the 17 warmest years on record have occurred in this current century and

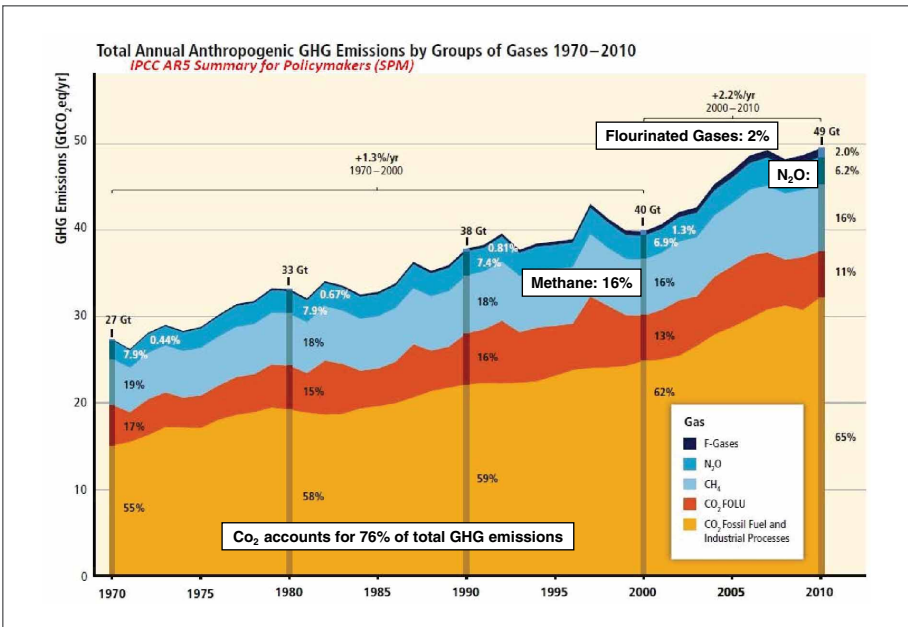


Figure: 2

2011-2015 was the hottest five-year period on record. 2016 was even hotter, with a global average temperature of 1.2° C above the long-term average. The graph at Figure 2⁷ shows that between the period from the year 2000 to 2010, GHG emissions were the highest in human history and, by 2010, had already reached 49 Gigatonnes of CO₂ Equivalent per Year (GtCO₂eq /yr).

Figure 3⁸ shows global CO₂ emissions since 1980 (solid black) and country pledges under the Paris Agreement (dashed) compared to a high emissions scenario (orange) and a scenario compatible with limiting warming to 2° C above pre-industrial levels (blue).

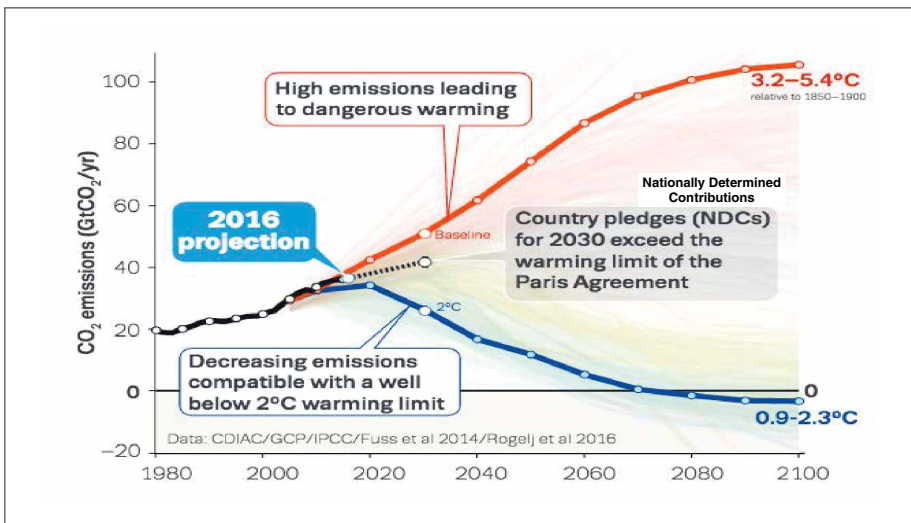


Figure: 3

With that as the backdrop, it is now appropriate to dilate upon just how each of the remaining four of these climate certainties impacts India's holistic security in general and her maritime security in particular.

7 IPCC, 2014: *Summary for Policymakers*. In: *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. https://www.ipcc.ch/pdf/assessment-report/ar5/wg3/ipcc_wg3_ar5_summary-for-policymakers.pdf

8 'Carbon Brief' website, 15 February, 2016. <https://www.carbonbrief.org/what-global-co2-emissions-2016-mean-climate-change>

HIGHER SURFACE, TROPOSPHERIC AND OCEAN TEMPERATURES

Figure 4⁹ depicts the rise in global mean surface temperature since the year 1880 and highlights the abnormally sharp spike experienced in 2016.

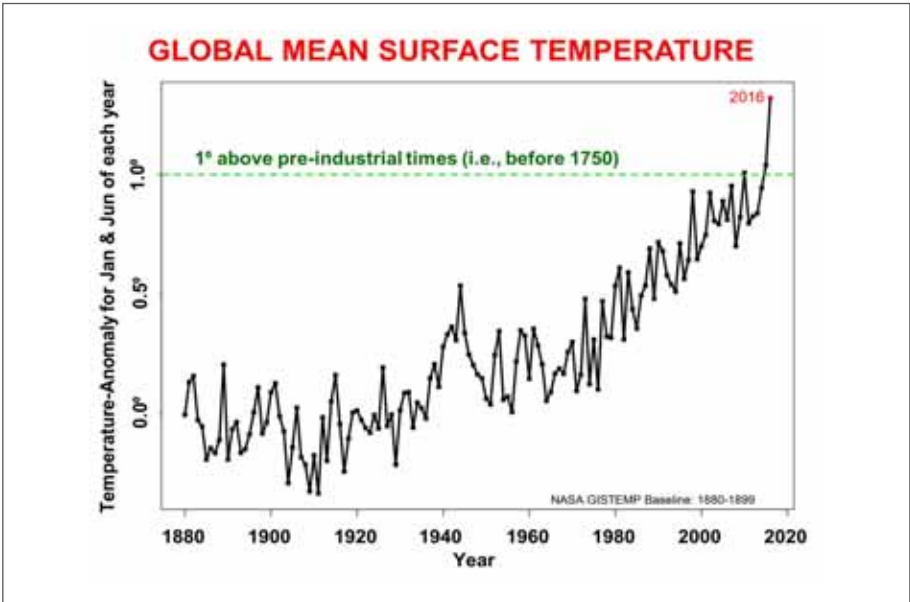


Figure: 4

Both, human beings and agricultural crops have a very limited tolerance for heat. If Greenhouse Gases and surface temperatures continue to rise as indicated in the foregoing figures, people in several countries of West Asia — and some in South Asia as well — Afghanistan and north-western Pakistan, for example — will begin to experience intolerable levels of heat stress. On the one hand, this will generate a significantly reduced work-efficiency and a corresponding risk of heat-stroke for people, such as farm and construction labour, who routinely work outdoors.

⁹ World Economic Forum, Geneva, Switzerland. <https://www.weforum.org/agenda/2016/05/this-animation-shows-how-the-earth-has-warmed-up-since-1850/>

As graphically depicted in Figure 5¹⁰, not only has India's summer mean temperature been steadily rising, the accumulated heat wave intensity, the number of heat wave events, the heatwave durations, and the number of heat wave days during the period 1985–2009 (relative to the previous period of 1960–1984) has increased significantly over most areas of India.

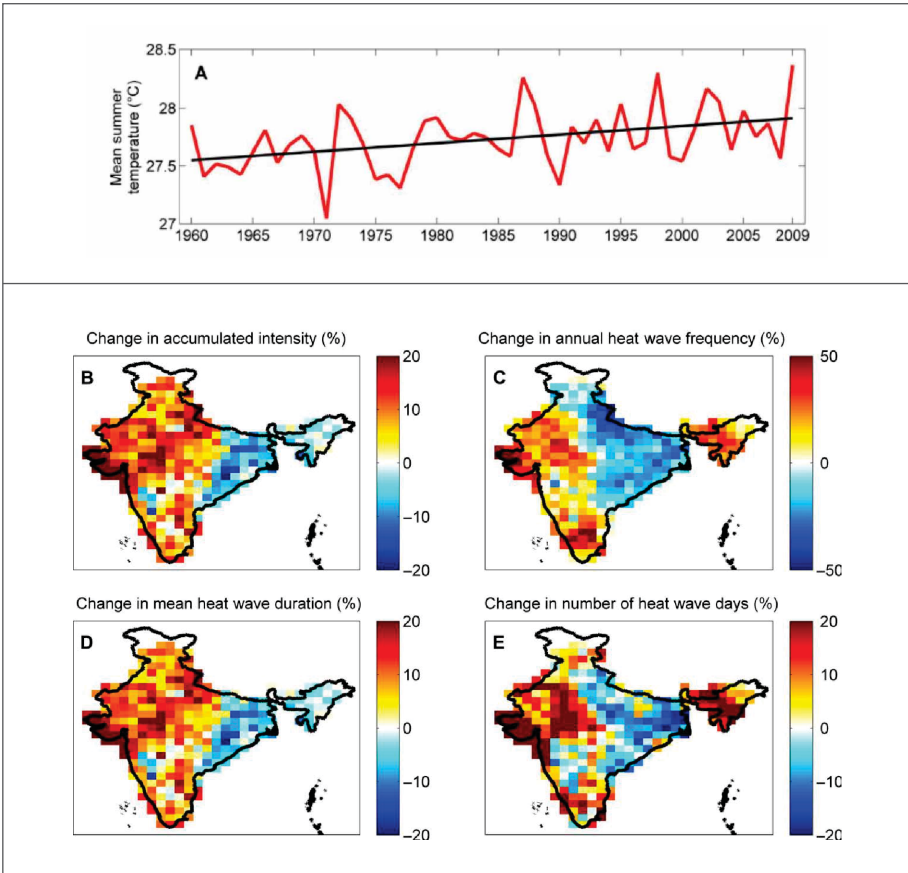


Figure: 5

10 Omid Mazdiyazni, Amir AghaKouchak, Steven J. Davis, Shahrbanou Madadgar, Ali Mehran, Elisa Ragno, Mojtaba Sadegh, Ashmita Sengupta, Subimal Ghosh, CT Dhanya, Mohsen Niknejad. "Increasing Probability of Mortality during Indian Heat Waves". 'Science Advances' Journal. Vol 3, No. 6, 02 June 2017 <http://advances.sciencemag.org/content/advances/3/6/e1700066.full.pdf>

While India's 'frugal innovativeness' (*jugaad*) could provide some degree of mitigation internally, the pressures upon India from its more severely affected immediate neighbourhood would be intense. Migration triggered by heat-stress has tended to attract less analytical scholarship than that triggered by floods, but recent findings show that in actual fact, migration is more likely as a response to slow-onset and recurring situations such as drought and desertification that destroy agriculture and other natural resources upon which communities depend for their livelihood. This will inevitably exacerbate existing geopolitical fault lines and create heightened socio-political unrest and upheavals and these will be dilated upon a little later in this monograph. However, it is immediately evident that waves of heat-induced human migration will be a significant factor in the context of both, internal security and external security of India. Given the latter context, it is clear that strategies to cope with such migration will be an important geopolitical driver.

WATER STRESS

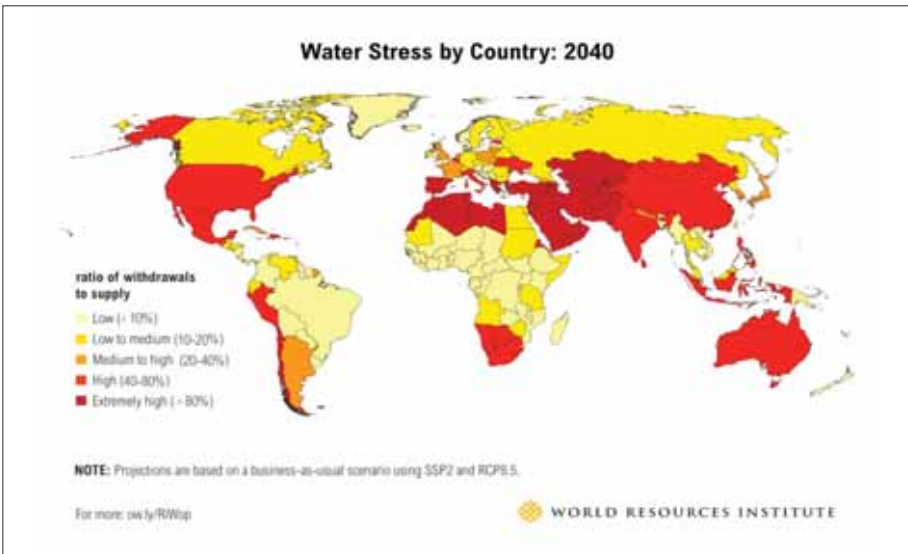


Figure: 6

An immediate result of widespread heat-stress is, of course, the scarcity of water that is usable to sustain life and livelihood. This scarcity is collectively known as ‘water-stress’. Although thresholds for water stress are largely arbitrary, thresholds of ‘moderate’, ‘chronic’ and ‘extreme’ water-shortage are widely used, based on the per-capita availability of water. The number of people exposed to extreme water shortage is projected to double, globally, by the middle of the current century due to population growth alone. Figure 6¹¹ depicts the distribution of water stress (as a function of water withdrawals to water-supply) in 2040.

One of the most commonly encountered security-impacts of temperature-rise and water-stress, both of which are manifestations of climate change, has been the occurrence of protracted and frequent droughts. Drought is a major challenge to people, agriculture and economies across the world. Droughts can be of several types — meteorological (a lack of precipitation), agricultural (a lack of water in the soil), hydrological (a deficit in river flows and groundwater levels), a water-resources drought (a deficit in the amount of water available for distribution to consumers), etc. They vary in their duration, intensity (amount of deficit) and spatial extent. There are also many different indicators of drought, tailored to different characterisations of the phenomenon. Consequently, drought is a difficult phenomenon to predict in terms of the occurrence, frequency and impact. However, whatever the cause and type, one ubiquitous consequence of drought is that it causes crops that are already under heat stress to undergo more extensive withering, and, food-security to plummet as a consequence of large-scale crop failure. ‘Crop failure’ is defined as an abnormal reduction in crop yield such that it is insufficient to meet the nutritional or economic needs of the community.¹² Professor Shi Yinhong of China’s Renmin University explains that “...*food could become the single most sought-after resource globally... Large fluctuations in price, or constraints on availability, could contribute to state failure... Pressure for secure, affordable supply, together with a loss of confidence in*

11 World Resources Institute Website. “Aqueduct Projected Water Stress Country Rankings”, August 2015. <http://www.wri.org/resources/data-sets/aqueduct-projected-water-stress-country-rankings>

12 World Health Organization: Glossary of Humanitarian Terms (2008). <https://definedterm.com/a/definition/120789>

the markets, would result in a high priority being placed on the security of imports. The risk of conflict would be significant in situations where the developing countries themselves faced shortfalls. At the same time, the importance of overseas assets to food security would lead great powers to invest more in defending strategic trade routes, which could themselves become subject to military confrontation.”

Figure 7¹³ zooms in on contemporary India, and shows that the situation obtaining, in terms of water-stress, is far from comforting.

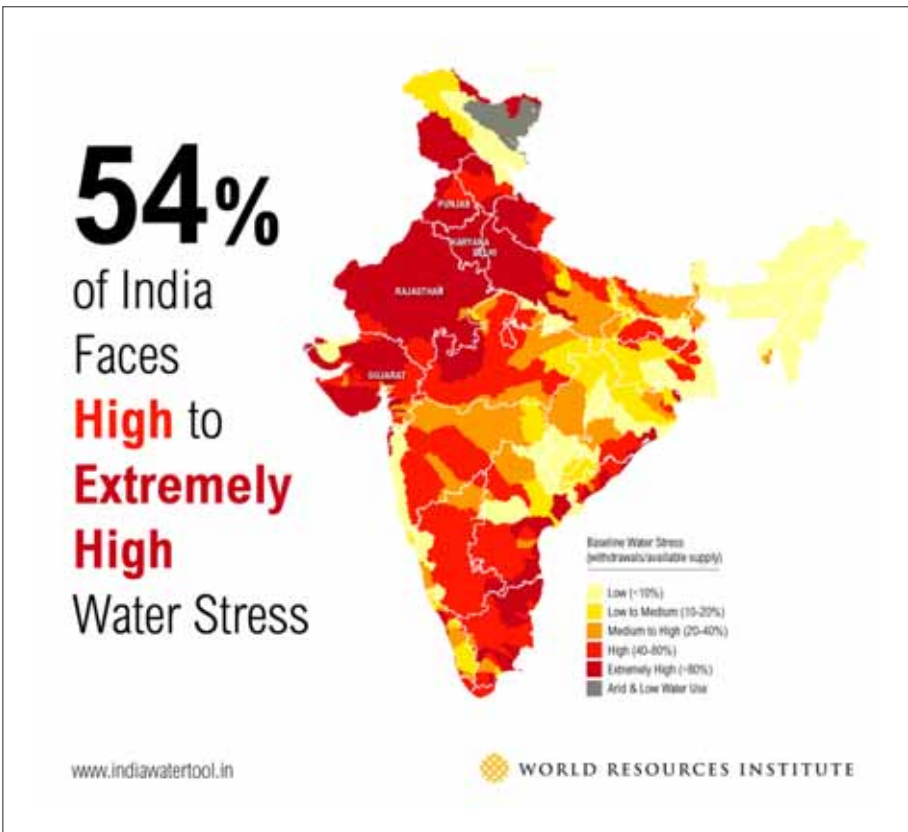


Figure: 7

13 Indiawatertool website: Baseline Water Stress. <http://www.indiawatertool.in/>

Increasing water scarcity will contribute to instability throughout the world, as populations migrate within and across borders, creating the conditions for social or political upheaval along the way. More immediately, it will promote violent actions by an increasing number of malevolent non-State actors and terrorist organisations.

While climate change is not, in and of itself, a cause of terrorism, it certainly exacerbates other socio-political and socio-economic causes of this phenomenon. In October of 2016, the highly-respected German (Berlin-based) think-tank, ‘Adelphi’, published a report¹⁴ that comprehensively examined the complex relationship between climate change and Non-State Armed Groups (NSAG). It emphasised that climate change acts as a ‘threat multiplier’, interacting and converging with existing pressures and greatly increases the likelihood of fragility or violent conflict. Not only States already experiencing fragility or conflict, but also apparently stable States, can be adversely affected by climate change adding to the combined pressures of population-growth, urbanisation, environmental degradation, and rising socio-economic inequalities. When these NSAG are represented by terrorist groups such as Al Qaeda, ISIS, or Al Shabaab, the linkages are of particular interest to those concerned with the security of the peoples of nation-states. Large-scale environmental and climatic change creates an environment in which such groups can thrive and opens spaces that facilitate the pursuit of their strategies. For instance, although it cannot be said that climate change created the ISIS, its rise in 2011 was certainly facilitated by the preceding four years of drought in Syria’s — one of the worst and widest droughts in that country’s history. The resultant enhancement of heat-and-water stress reached intolerable proportions and sent hundreds of thousands of Syrians into extreme poverty and food insecurity and generated a huge exodus from the rural areas of Syria towards Damascus. The government of President Assad was in no position to handle this pressure and the brutal actions ordered to be taken by Assad’s security forces were repressive and draconian in the extreme, greatly exacerbating an already explosive situation. Socio-political unrest flared sharply and the result was the rise of the *Daesh/Islamic State*

14 Adelphi Report, October 2016: “Insurgency, Terrorism and Organised Crime in a Warming Climate”. <https://www.climate-diplomacy.org/file/2988/download?token=NKBhgKxo>

(IS).¹⁵ Of greater concern to security is that ongoing climate analyses and climate-model simulations uniformly indicate that as a direct consequence of human interference in the climate system, a drought of the severity and duration of this Syrian drought is now become more than twice as likely as it was in the early years of the previous decade.

As climate change adversely impacts livelihoods through food insecurity, heat-stress and water-stress, as also the loss of arable land due to desertification or a rise in the sea level (especially in coastal areas) with an attendant rise in the salinity of the ground water available in coastal land-based aquifers and in well-water, it increases the vulnerability of sizeable affected populations to recruitment by NSAG, especially terrorists. These criminal groups hold out the promise of alternative livelihoods and economic incentives and entice an increasingly desperate populace. For instance, the food and water shortages and near-economic collapse in Chad, resulting from the drought conditions caused by climate change, made worse by incoherent and ineffective policies by weak governments, have provided a ripe recruiting ground for the *Boko Haram* terrorist group operating out of Nigeria (See Figure 8¹⁶).



Figure: 8

¹⁵ Adelphi Report, October 2016: "Insurgency, Terrorism and Organised Crime in a Warming Climate", pp. 20-27.
<https://www.climate-diplomacy.org/file/2988/download?token=NKBhgKxo>

¹⁶ Source: Reuters

Recruitment has risen in direct correlation with the increase in the extent of the drought-ravaged region around Lake Chad (located just east of Nigeria) and the alarming shrinking of what used to be the largest lake in the world, as shown in Figure 9.¹⁷



Figure: 9

These very same conditions, resulting from heat-and-water stress engendered by climate-change, have similarly facilitated the rise of the *al-Shabaab* terrorist group in Somalia, some of whom are shown in Figure 10.¹⁸



Figure: 10

17 Source: 'Bigthink' Website. <http://bigthink.com/strange-maps/95-the-incredible-shrinking-lake-chad-that-is>

18 Source: The Star, Kenya. https://www.the-star.co.ke/news/2017/03/08/al-shabaab-top-leader-hussein-mukhtarsurrenders-to-somali-army_c1520634

Water-stress also leads to the breakdown of local authority and its replacement by whosoever controls this increasingly scarce resource. The ‘weaponisation’ of water can take the form of using it as a source of funding by taxing it. This is exemplified by a well-recorded instance of October 2014, when the Credit Bank in Raqqa, which was then ISIS’s *de facto* capital, became the designated ‘tax authority’ of the ISIS to collect payments from business for water (along with electricity and security).¹⁹ It would be recalled that by mid-2015, the ISIS had gained territorial control over large parts of Syria and Iraq, which included much of the water infrastructure of the Euphrates River, which is critical for food, water, energy and industry. This is depicted in Figure 11.²⁰

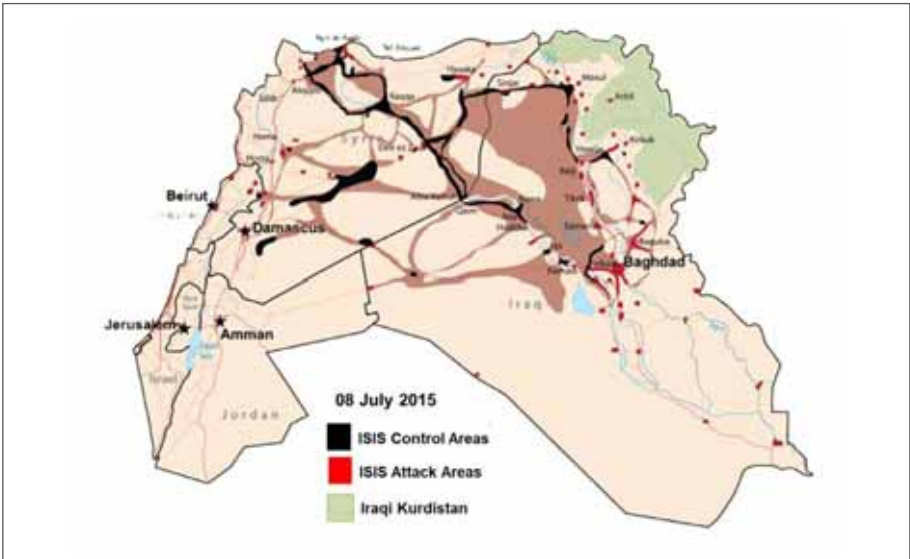


Figure: 11

This ‘weaponisation’ of water also has a more direct form, whereby terrorist groups either deny water to their adversaries or use water to flood areas populated by their adversaries. In October, 2014, the ISIS executed both forms of this weaponisation in

19 Marcus DuBois King. “The Weaponization of Water in Syria and Iraq”, *The Washington Quarterly*, Volume 38, 2015 - Issue 4 <https://pdfs.semanticscholar.org/b94f/9f9e4d8c99429c7a134ca618c38631d6c6f1.pdf>

20 The Institute for the Study of War. http://www.understandingwar.org/sites/default/files/July_08_2015_Sanctuary_Map.pdf

Iraq. On the one hand, it cut off water from the Khalis tributary of the Tigris River for 10 days, suspending the drinking water supply to villages by the Iraqi towns of Mansouriya, Salam, and Sarajiq, while on the other, it diverted the Khalis to flood parts of the town of Mansouriya in Iraq's Diyala province. According to a local official, this action flooded over 780 acres of agricultural land and inundated homes with up to two metres of water, causing hundreds of families to flee.²¹ Likewise, in 2015, the IS closed the gates of the Ramadi dam in Iraq (See Figure 12) in order to more easily attack the regime's forces located farther downstream.



Figure: 12

21 Marcus DuBois King. "The Weaponization of Water in Syria and Iraq", *The Washington Quarterly*, Volume 38, 2015 - Issue 4 <https://pdfs.semanticscholar.org/b94f/9f9e4d8c99429c7a134ca618c38631d6c6f1.pdf>

Things are likely to get worse, for in January of 2016, the world was a mute witness to the frightening spectacle of the '*Al Shabaab*' being actively and openly wooed, within Somalia, by two far more deadly terrorist organisations, namely, the '*al Qaeda*' and the '*Islamic State*'! Even more worryingly for maritime security agencies, early signs of the entry of such terrorist groups into the maritime domain may be clearly seen in the piracy incident off Somalia on 13 March 2017 — the first major one in the past couple of years — in which Somali pirates, having merged seamlessly with *al-Shabaab*, hijacked an Emirati oil tanker, the *Aris 13*. It is cold comfort to realise that the dire warnings over the past few years by this author that pirates and maritime criminals were likely to morph into terrorism — until recently dismissed as Cassandran prophecies — have translated into reality. Cooperation between Somalia's *al-Shabaab* fighters and pirate gangs is increasingly clear and obvious, especially as *al-Shabaab* becomes more desperate for funding and, like the Somali pirate-lords of the last decade, realises that piracy is a lucrative source of large sums of easy money.

It is not only Non-State Armed Groups that are taking advantage of water-stress resulting from climate-change. In several cases, Westphalian nation-states, too, are teetering dangerously and often alarmingly on the very brink of armed conflict as a consequence of water-stress exacerbated by population-growth and climate-change. This is especially true of arid and semi-arid regions, where droughts tend to sharply amplify water-stress and reduce food security. This often leads to a vicious cycle in which climate change influences conflicts and conflict is worsened by climate change. Countries that share the same river are particularly vulnerable to this cycle. Because upstream water-management influence downstream discharge and water-quality, confidence amongst lower riparian States in the methods of water-management adopted by upper riparian States gets shakier as climate-change induces water-stress.

Water scarcity also shapes the geopolitical order when States engage in direct competition with neighbours over shrinking water supplies. Thus, Egypt, Ethiopia and Sudan wrangle over access to the rivers that feed the Nile; Turkey and Iraq over dams on the Tigris; and Israel and its Arab neighbours over access to waters of the Jordan.²²

22 Justin Rowlatt. "Why India's Water Dispute with Pakistan Matters". BBC Online News, 28 September 2016. <http://www.bbc.com/news/world-asia-india-37483359>



Figure: 13

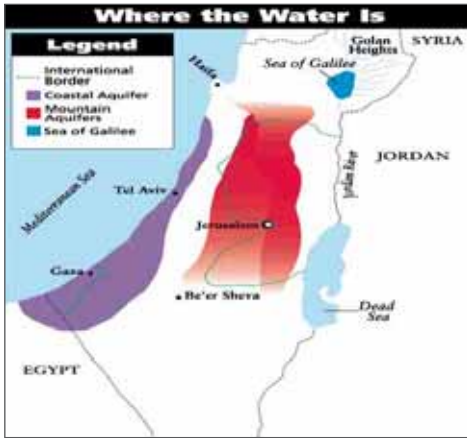
Turkey, for example, is the only country in the Middle East that does not depend on water supplies that originate outside of its borders. This may be seen in Figure 13. However, climate change has left all other countries that are dependent on water from the Tigris and Euphrates Rivers more vulnerable to a deliberate supply disruption by Ankara. Turkey is seeking to maximize this leverage. Its 22 dams and 19 power plants along the

Euphrates give it the capacity to cut Syria's water supply by up to 40% and Iraq's water supply by up to 80%. Syria is, therefore, constrained in its ability to ignore or alienate Turkey — unless, of course, it chooses a course of direct military confrontation.

Likewise, Israel's geopolitical game moves are largely a function of Tel Aviv's desire to be free from the yoke of water-dependence upon Turkey. With the major aquifers, access to which could enable Israel's water security, being located in the West Bank and the Golan Heights, (as may be seen in Figure 14²³) control over these areas becomes essential. Control over water has thus been amongst the more prominent drivers of Israel's military confrontation with Syria and Jordan. Israel has no plans to make peace with Syria and return the Golan Heights, because by doing so it would give up its control of springs, rivers and the Sea of Galilee. Nor will it hand over any significant West Bank land to Palestinians, for in doing so Israel would have to abandon lush aquifers (underground water reserves), key access to the Dead Sea, the Jordan River, and surrounding fertile plains.²⁴

23 Aubrey Wulfsohn. "What Retreat from the Territories Means for Israel's Water Supply". Think-Israel Website, 02 May 2005. <http://www.think-israel.org/wulfsohn.water.html>

24 Isabelle Humphries. "Breaching Borders: The Role of Water in the Middle East Conflict". American Educational Trust, Washington Report on Middle East Affairs, September-October 2006. <https://www.wrmea.org/2006-september-october/breaching-borders-the-role-of-water-in-the-middle-east-conflict.html>



*AQUIFER LOCATIONS ARE APPROXIMATE

Figure: 14

Closer home, Afghanistan, a country with negligible food security and one that is riven by internecine conflicts, is also acutely vulnerable to climate change. Here, at the other end of the spectrum of economic prosperity and far removed from the cocooned self-absorption of the current administration of the USA, one finds the polar opposite view of that held and articulated by President Donald Trump. As unequivocally stated by Mostapha Zaher, Director General of the National Environmental

Protection Agency of Afghanistan, “Climate change is real. I invite anyone who may still doubt this to visit Afghanistan, and witness first-hand the alarming melting of the Pamir/Hindu Kush glaciers in the country’s north-east. Afghanistan has already been, and will continue to be, heavily affected by the negative impacts of climate change. And it is the most vulnerable people— particularly subsistence farmers and pastoralists who depend on natural resources for their survival – who are suffering most.”²⁵ Already, more than half of all local conflicts in Afghanistan are over arable-land and water. Diminishing rainfall and advancing desertification are likely to spark further violent clashes between nomads and pastoralists over access to pastures and water and food.

Farther south, Pakistan, too, is extremely vulnerable to heat and water stress. Pakistan has faced record temperatures and water shortages in recent years. In June of 2015, a heatwave in Karachi claimed over 1,200 lives.²⁶ The possibility of climate change and environmental factors destabilizing Karachi, which is regarded

25 Mostapha Zaher. Foreword in Report: “Climate Change in Afghanistan: What does it mean for Rural Livelihoods and Food Security?” Jointly produced by the World Food Programme (WFP), the United Nations Environment Programme (UNEP) and Afghanistan’s National Environmental Protection Agency (NEPA), November 2016. https://postconflict.unep.ch/publications/Afghanistan/Afg_CC_RuralLivelihoodsFoodSecurity_Nov2016.pdf

26 Sualiha Nazar. “Pakistan’s Big Threat Isn’t Terrorism — It’s Climate Change”. Foreign Policy, 04 March, 2016. <http://foreignpolicy.com/2016/03/04/pakistans-big-threat-isnt-terrorism-its-climate-change/>

as the country's economic backbone, is now recognised as being real and temporally proximate if not imminent. With a population of approximately 17 million people, Karachi accounts for 42 per cent of Pakistan's total GDP. It generates about half of Pakistan's tax revenue, and houses its stock exchange, central bank, and the priciest real estate in that country. The droughts are exacerbated by poor water-management infrastructure, raising tensions between provinces and with neighbouring India, with whom Pakistan shares the tributaries of the Indus River under the terms of a 1960s World Bank-moderated treaty agreement.²⁷ A 21-year survey conducted in rural Pakistan between 1991 and 2012 has established a strong causal relationship between heat-and-water stress and migration.²⁸ As the climate-driven migrant population from Afghanistan pushes south eastwards and Pakistan — whose population is, in any case, burgeoning and putting pressure on already stretched resources of arable land, food and water — begins to witness a south-easterly migration of its own population, the strain upon India will increase to the point where the 'weaponisation' of water — despite agreements such as the Indus Water Treaty of 1960 — could become a cause for serious conflict. Readers may be aware that under the Indus Water Treaty, control over the three eastern tributaries of the Indus River — Ravi, Sutluj, and Beas — has been granted to India, while that over the three western tributaries — Indus, Jhelum, and Chenab has been granted to Pakistan. Both states are required to ensure the flow of their rivers into the neighbouring State, with minor exceptions, including the development of particular hydropower projects and water extraction for agricultural use. In Pakistan, 90% of the country's food and 65% of its employment depend on agriculture sustained by the Indus Basin and its tributaries. The treaty is increasingly strained as both sides pursue hydro-development projects to mitigate water and energy shortages; or to take pre-emptive action against natural disasters, such as flooding or drought, which are becoming more frequent and intense with climate change. Some Pakistanis hold

27 Arpita Bhattacharyya and Michael Werz. "Climate Change, Migration, and Conflict in South Asia: Rising Tensions and Policy Options across the Subcontinent". Center for American Progress, December 2012. https://www.americanprogress.org/wp-content/uploads/2012/11/ClimateMigrationSubContinentReport_small.pdf

28 V. Mueller, C. Gray, and K. Kosec. "Heat Stress Increases Long-term Human Migration in Rural Pakistan". *Nature Climate Change* Vol 4, pp. 182–185 (2014). <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4132829/>

the wholly incorrect view that India uses its upstream dams to manipulate how much water flows down into Pakistan via the Indus. However, India could certainly do so if it so chooses. Climate change is expected to further challenge water distribution and hydro-development in Pakistan and India, thereby significantly impacting security, especially as this inherent suspicion and mistrust between the two States is used by terrorist groups to provoke anti-Indian sentiment in Pakistan, providing fertile ground for conflict.

WATER SURFEIT

If heat- and water-stress constitute one face of the adverse security-impact of climate change, water surfeit is its opposite face, but it, too, has an equally adverse security-implication. An increase in rainfall can be a blessing for a country that has the ability to capture, store, and distribute the additional water, but is a curse for a country that does not have adequate land management practices or infrastructure. Even where it is a blessing, the 'blessing' is likely to be a mixed one, because regions that benefit from additional rainfall will also need to cope with an influx of migrants from water-scarce areas, thereby aggravating existing national and/or inter-State tensions. Within India itself, extensive flooding caused by heavy rainfall has become endemic in large portions of the country. In 2017, the states of Gujarat, Bihar, J&K, Maharashtra (including Mumbai) and even parts of Rajasthan were quite unable to handle increased rainfall, requiring the intervention of all three defence services for in-country Humanitarian-Assistance and Disaster-Relief (HADR) operations in aid of civil power. Where the rainfall is both heavy and unseasonal, the call for HADR from the defence services is even more strident, as was the recent case in Uttarakhand (2013), J&K (2014) and Tamil Nadu (2015).

This inability to deal with increased rainfall extends across much of India's neighbourhood, with Sri Lanka, Nepal and, farther afield, the Philippines, all offering recurring examples. While in the civilian world, 'humanitarian logistics', which forms the core of HADR operations, is less well-established a discipline than 'commercial logistics', the three defence services of India are extremely good

at transferring their established competence in military logistics into practices, procedures and processes needed for humanitarian logistics. Thus, on the one hand, there is much to be commended in the comprehensiveness and alacrity with which the Army, Navy and Air Force, under the coordinating-umbrella of HQIDS, have responded to each such crisis. On the other, each of them is, nevertheless, experiencing a sharp increase in ‘operational stretch’ precisely because of the increased demand across the region for HADR. As these adverse effects of climate-changes inexorably increase, the operational load that HADR places upon this already-stretched instrument of the Indian State will increasingly impact other facets of national security that it is expected to provide.

Another security-impact of climate change that is grossly underestimated is that caused by changing/stronger disease vectors that arrive in its wake. This is sought to be summarised in Figure 15. There is little doubt that climate change will have a range of decisively negative effects on global health during the next three decades, particularly in the developing world. Water-borne and vector-borne diseases, such as malaria and dengue fever, will be most prevalent in countries that experience significant additional rainfall due to climate change. Conversely, many airborne diseases will thrive in those areas that become more arid due to drought and higher temperatures.



Figure: 15

Shortages of food or fresh drinking water will also render human populations more susceptible to illness and less capable of rapidly recovering. Moreover, the risk of a pandemic is heightened when deteriorating conditions prompt human migration. The attendant security impact on the geopolitical landscape is not hard to imagine. It is easy enough to comprehend the threat posed to human security by more frequent and vigorous outbreaks of diseases, epidemics and even pandemics. And yet, security analysts, militaries and governments often seem to be unable to make the security-connection between these phenomena and conflict. In the face of an epidemic in a given part of the world, it is not uncommon to find countries imposing varying degrees of restrictions upon the free movement of people from affected countries into one's own countries. However, should these restrictions or total bans be applied to merchandise that is traded in bulk, the geopolitical ramifications can be very serious. A nation whose merchandise trade is affected in this way might well react strongly and adversely, especially if the commodity concerned constitutes a significant percentage of its GDP. Let us take a case where a country has bananas as its principal export to a specific destination-country. Assume that this export is a major determinant of the country's socio-economic wellbeing and contributes very significantly to its GDP. If the destination-country now states that the bananas of a given period are diseased and cannot be allowed in, the geoeconomic effects upon the exporting country can be extremely severe. If the destination-country wishes to impose its geopolitical will upon the exporting country, it is not difficult to see how even just the 'threat' of imposing a ban upon the banana-crop could force the export-dependent country to accede to this geopolitical pressure. If, however, the exporting country was a powerful one, it could execute more aggressive geostrategies of its own, which might easily mutate from a trade/health dispute into a major conflict. Can this happen as a result of climate change? Certainly. Could this effect of climate change be used as a geopolitical ploy by a given country to exert its geopolitical will upon another? Absolutely.

GLACIAL LAKE OUTBURST FLOOD (GLOF)

Closer home, the security impact upon India of the receding of Himalayan glaciers as a result of climate change is evident in Nepal, which frequently suffers sudden and

devastating floods as a result of the bursting of glacial lakes. A glacial lake outburst flood (GLOF) is actually particularly telling example of the adverse security-impact of climate change, in that it is the result of a combination of increased heat from the emission of greenhouse gases, and a sudden water-surfeit causing flooding. A glacial lake is formed when a glacier retreats and the residual ice sheet turns to water. The receding of the glacier itself is, of course, a result of the climate-change-driven phenomenon of surface and tropospheric warming. This water is naturally dammed by the exposed mass of debris at the end of the glacier — the ‘end moraine’. Moraine dams are composed of unconsolidated boulders, gravel, sand, and silt and they eventually break, often catastrophically, leading to a GLOF event. Figure 16²⁹ schematically depicts a GLOF. As shown, potential triggers include: (A) contact glacier calving; (B) icefall from hanging glaciers; (C) rock/ice/snow avalanches; (D) dam settlement and/or piping; (E) ice-cored moraine degradation; (F) rapid input of water from supra-, en-, or subglacial (including subaqueous) sources; (G) seismicity conditioning factors for dam failure. These include (a) large lake volume; (b) low width-to-height dam ratio; (c) degradation of buried ice in the moraine structure; (d) limited dam freeboard. The key stages of a GLOF event include (1) propagation of displacement or seiche waves in the lake, and/or piping through the dam; (2) breach initiation and breach formation; (3) propagation of resultant flood wave(s) down-valley.

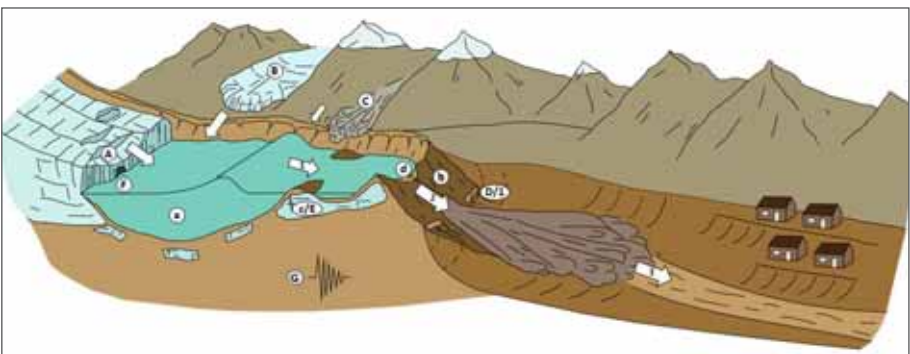


Figure: 16

29 Lake Scientist Online Journal. <http://www.lakescientist.com/research-summary-challenges-associated-modelling-outburst-floods-moraine-dammed-glacial-lakes/>



Figure: 17

Several GLOFs have trans-boundary impacts. For instance, many floods in Nepal have originated in Tibet, and similarly, floods from Nepal do not respect national boundaries and run into India and even Bangladesh. Among the most critical and dangerous of Nepal's glacial lakes is the Tsho Rolpa Lake, depicted in Figure 17,³⁰ which is the

largest moraine-dammed proglacial lake of the Nepal Himalayas. It is fed by the Traskarding Glacier, which is retreating at an average rate of over 20 metres per year, and in some years within the last decade, at an astonishing 100 metres a year.

In a GLOF event, violent flood waves reaching as high as 15 metres destroy downstream settlements, dams, bridges, and other infrastructure. Where Nepal is concerned, this puts further stress on a country already struggling to preserve a fragile peace and reintegrate tens of thousands of Maoist insurgents — the failure of which could destabilise much of India and even South Asia at large. With China's geopolitical game-plays in Nepal a source of frequent Sino-India tension at the strategic level, all this has security implications of very significant proportions.

MARITIME ISSUES

The security-impacts of climate change are felt particularly strongly within the maritime domain — upon, below and above the seas, as also within the coastal areas of littoral countries such as India. Here, rising surface temperatures have the direct effect of increasing the frequency, severity, and path-unpredictability of cyclones. Future projections based on high-resolution dynamical models consistently indicate

³⁰ Image Source: Adventure Travel Blog. <https://trekkingnepalhimalaya.org/tag/tsho-rolpa-lake/>

that GHG-induced surface warming will cause the globally averaged intensity of tropical cyclones to decidedly shift towards stronger storms, with intensity increases of 2 to 11% by 2100.³¹ These modelling studies typically project substantial increases in the frequency of the most intense cyclones, and increases of the order of 20% in the precipitation rate within 100 km of the storm centre. In addition, these deleterious consequences are accompanied by a number of secondary and tertiary adverse effects. In a country like India, the Armed Forces are the principal first-responders to any disaster — and sometimes the only ones! Within a maritime domain that is being increasingly violently roiled by climate-change-induced cyclones and floods, the already high operational strain upon the Navy and the Coast Guard will increase manifold. Further, the more the mitigation mechanisms that are brought into play, the more will be the financial outlay needed and the greater will be strain on defence and naval budgets. The impact of this robbing of Peter to pay Paul will inevitably be felt in terms of decreased readiness to meet other maritime threats and challenges, including those arising from State challengers such as China and Pakistan, and/or malevolent State-sponsored non-State actors. Nor are these strains limited in their scope and applicability to the geographical extent of India alone. As the predominant regional maritime power, India is driven, as much by humanitarianism as by enlightened self-interest, to ensure the safety, security and stability of the littoral States located in the maritime region of its immediate interest. As such, cyclone damage and the disruption caused by the consequential flooding in countries such as Sri Lanka, Maldives, Seychelles, etc., will call for mitigating measures from the Indian Navy. Once again, the operational stretch resulting from enhanced involvement in Humanitarian Assistance and Disaster Relief (HADR) operations will be enormous. The huge effort put-in by the Navy, in end-May and early-June of 2017, to help Sri Lanka deal with the devastating effects of flooding is an indicative case-in-point.

There is global unanimity in the understanding that South Asia will be among the regions hardest hit by climate change. Higher temperatures, more extreme weather,

31 Thomas R. Knutson, John L McBride, Johnny Chan, Kerry Emanuel, Greg Holland, Chris Landsea Isaac Held, James P Kossin, AK Srivastava and Masato Sugi. "Tropical Cyclones and Climate Change". *Nature Geoscience*, 21 February 2010 <http://shoni2.princeton.edu/ftp/lyo/journals/Knutson-et-al-TCClimateChange-A-NatGeoSci2010.pdf>

rising sea levels, increasing cyclonic activity in the Bay of Bengal and the Arabian Sea, as well as floods in the region's complex river systems will complicate existing development and poverty reduction initiatives. Coupled with high population density levels, these climate shifts have the potential to create complex environmental, humanitarian, and security challenges. The impact of the increased frequency cyclones and more intense storm activity, as also the extensive attendant flooding will be particularly severe upon Bangladesh and upon India's east coast. The consequences of climate change will radically alter living conditions and seriously undermine livelihoods. The increase in frequency of such extreme events and deteriorating conditions are likely to force many to leave their homes temporarily or even permanently and become, in and of themselves, drivers for climate-induced human migration. Where will these migrants from Bangladesh go? Into India, of course, but where in India? Probably along the east coast and into the 'Red Corridor' — already an enormous gash where the writ of New Delhi runs far more weakly than one would wish. The security implications need little elaboration, but nevertheless demand much contingency-planning at not just the strategic level, but the operational and tactical ones, too.

President Donald Trump's views notwithstanding, any residual uncertainty surrounding the specific implications of climate change and migration on security and stability is no longer an excuse for inaction. A 2009 Report of the UN Secretary General has outlined a number of second-order effects of unsuccessful adaptation in the form of uncoordinated coping or survival strategies of local populations, including involuntary migration, competition with other communities or groups over scarce resources, and, an overburdening of local or national governance capacities. Since the rising trend of these effects of surface warming have been extensively modelled and are increasingly being proven by actual events, it behoves the Indian Navy and the Indian Coast Guard to devote serious attention to the multifarious implications of this increased operational stretch and decreased budgetary support. Individual calls for action need to be expeditiously translated into institutional and structured organisational responses that will draw-up a series of contingency-based coping plans and methodologies.

This story of HADR-generated operational-stretch is repeated in the extensive flooding attendant upon cyclones and storm-surge activity, whose increased frequency

and intensity are, once again, manifestations of climate change. India's humanitarian response to the trail of death and destruction caused in the Philippines by Cyclone Haiyan in December 2013 was given tangible manifestation almost entirely by the efforts of the army, navy and air force. Closer home, the havoc wreaked by Cyclone Hud-Hud in August 2014 saw the Indian Armed Forces successfully launch HADR operations on a massive scale. With the anticipated increase in the frequency and the intensity of cyclones and storm-surges, the Indian Navy, in particular, will need to draw up detailed contingency plans to deal with the inundation of its coastal infrastructure, including, in several cases, its current base-ports and their associated waterfront facilities.

Mitigating the deleterious effects of the 'operational stretch' while dealing proactively with that this facet of climate change is, perhaps, best done through regional cooperative mechanisms, in which several countries contribute. There are, additionally, important beneficial geopolitical spin-offs to regional cooperation. Where maritime HADR is concerned, the Indian Ocean Rim Association (IORA) offers an extant and mature structure for the dissemination of political direction. Likewise, functional instruments through which such regional approaches can optimally be made within the Indo-Pacific are already available — in the form of the Western Pacific Naval Symposium³² (WPNS) and the Indian Ocean Naval Symposium (IONS). Some members of the IONS construct are also members or observers of the WPNS and this inclusiveness can and should be leveraged to advantage. The Indian Ocean has long lacked a suitable security structure and IONS answers this need, at least within the maritime domain, since it brings together the principal maritime organisations (mostly navies, but sometime coast guard structures and, on occasion, even police forces) of 27 littoral states of the Indian Ocean Region. Sub-regional maritime issues, including HADR are handled by grouping the countries into four littoral sub-regions.³³

32 **WPNS Members:** Australia, Brunei, Cambodia, Canada, Chile, France, Indonesia, Japan, Malaysia, New Zealand, Papua New Guinea, Peoples' Republic of China, Philippines, Republic of Korea, Russia, Singapore, Thailand, Tonga, United States of America, Vietnam. **Observers:** Bangladesh, India, Mexico, Peru.

33 **IONS Members: South Asian Littorals:** Bangladesh, India, Maldives, Pakistan, Seychelles, Sri Lanka and the UK. **West Asian Littorals:** Iran, Oman, Saudi Arabia and United Arab Emirates. Bahrain, Iraq, Israel, Jordan, Kuwait, Qatar, and Yemen are yet to formally join. **East African Littorals:** France, Kenya, Mauritius, Mozambique, South Africa, and Tanzania. While Madagascar is an Observer, Comoros, Djibouti, Egypt, Eritrea, Somalia and Sudan, are yet to formally join. **South East Asian and Australian Littorals:** Australia, Indonesia, Myanmar, Singapore, Thailand and Timor-Leste. Malaysia is currently an Observer. **Observers:** China, Germany, Japan, Madagascar, Malaysia, Russia and Spain.

HADR (Humanitarian Assistance and Disaster Relief) exercises and operations are the most readily acceptable and, regionally, the most useful, of all cooperative maritime activities. For instance, the Hawaii-based headquarters of the US Pacific Command (PACOM), has built upon the effectiveness of the humanitarian relief provided by the hospital ship, the USNS *Mercy* in the aftermath of the *tsunami-earthquakes* of 2004 (Indo-Pacific) and 2005 (Java, Indonesia). HADR missions, termed "*Pacific Partnership*" were successfully launched to provide succour and relief across the PACOM 'Area of Operations' (AOR). The USNS *Mercy* is deployed on these missions every alternate year, while the US Navy deploys an LPD in the 'gap' years. PACOM invites the militaries of all nations within its AOR to partner with it in these annual humanitarian missions. India had initially responded admirably, sending multi-disciplinary medical and associated support-personnel, drawn from all three Armed Forces, aboard the USNS *Mercy* and the USS *Peleliu*, for three years — 2006, 2007, and, 2008. Over these three years, the significant and meaningful contribution of the Indian contingent, in providing medical succour and humanitarian relief to stricken people of the region, was genuinely beneficial and was extremely well-appreciated. However, domestic political vicissitudes intervened and after these three years, Indian participation ceased presumably on the insistence of the Left parties in the UPA-1 government, which argued that no matter how regionally relevant in terms of humanitarian assistance and no matter what the fringe benefits were, these missions were a US-Flag multilateral-construct and not a UN-Flag one. In seeking to avoid being 'seen' as a partner-nation to the US Navy even within a humanitarian paradigm, India chose not to be 'seen' at all — thereby throwing out the baby with the bathwater! This short-sightedness is doubly ironic because, by 2008, the Indian Navy had already launched the IONS security construct in a hugely successful manner. However, in the ensuing years, the country lost multiple opportunities to launch HADR Missions within the Indian Ocean region under the aegis of IONS.

Clearly, there are also several specifically-maritime manifestations of security infirmities caused by climate change — and India's is a particularly critical case. The UK Foreign and Commonwealth Office's most recent report

on the risks involved in climate change³⁴ unequivocally states that with 1 metre of rise in the global sea level, *“the probability of what is now a ‘100-year flood event’ becomes about 40 times more likely in Shanghai, 200 times more likely in New York, and 1000 times more likely in Kolkata. Defences can be upgraded to maintain the probability of a flood at a constant level, but this will be expensive, and the losses from flooding will still increase, as the floods that do occur will have greater depth.”* The term ‘100-year flood’ is used in an attempt to simplify the definition of a flood that statistically has a 1% chance of occurring in any given year. In other words, over the course of a million years, these events would be expected to occur 10,000 times. However, just because it rained 10 inches in one day last year doesn’t mean it can’t rain 10 inches in one day again this year!³⁵

Recurrence intervals and probabilities of occurrence may be understood from the tabulation at Figure 18:

Recurrence interval (in years)	Probability of occurrence in any given year	Percent chance of occurrence in any given year
100	1 in 100	1
50	1 in 50	2
25	1 in 25	4
10	1 in 10	10
5	1 in 5	20
2	1 in 2	50

Figure: 18

34 Sir David King, Arunabha Ghosh, Prof. Daniel Schrag, Prof. Zhou Dadi, Prof. Qi Ye. “Climate Change: A Risk Assessment”, Centre for Science and Policy, Cambridge University. <http://www.csap.cam.ac.uk/projects/climate-change-risk-assessment/>
 35 US Geological Survey (USGS) Website. “Floods: Recurrence Intervals and 100-year Floods”, The USGS Water Science School. <https://water.usgs.gov/edu/100yearflood.html>

SEA-LEVEL RISE

Turning to the impact upon maritime security of the melting of the polar ice sheets, the situation is gradually approaching criticality. The percentage contribution of the melting of land ice to sea level rise is some 52%, while another 38% is contributed by the thermal expansion of the oceans as a result of surface and tropospheric warming. Rising sea levels are a far more immediate problem than most Indian analysts realise. Figure 19³⁶ shows the likely ranges of this rise, between now and the end of this century.

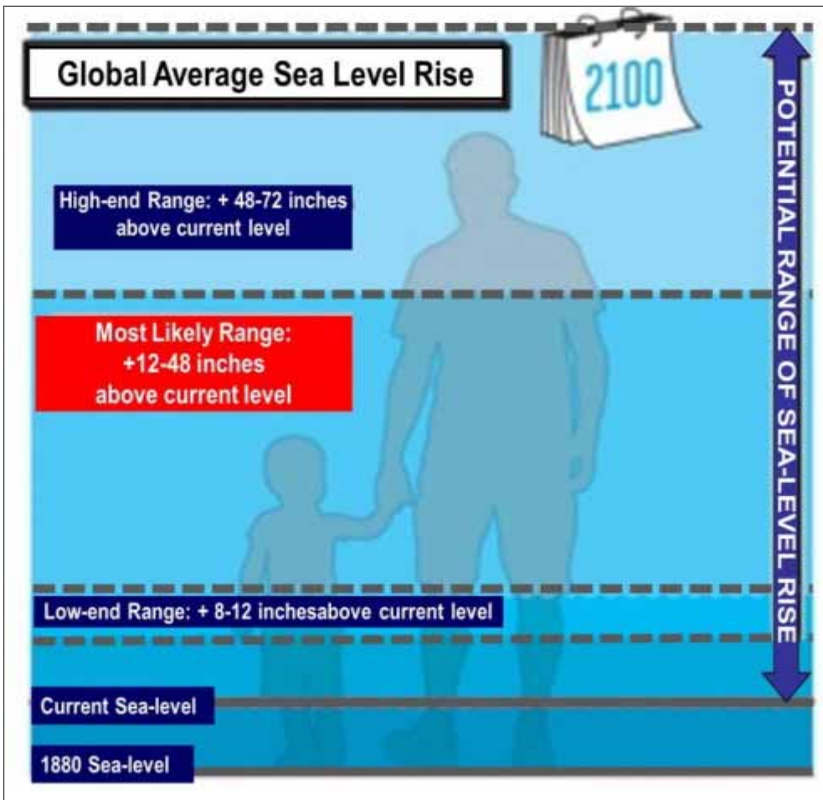


Figure: 19

36 Image Source: http://www.ucsusa.org/global_warming/science_and_impacts/impacts/infographic-sea-level-rise-global-warming.html#.Wbiam8gHIU

Indeed, if one were to rank countries according to the total number of people who would be at severe risk from a rise in sea level, India stood at ‘Number One’ in 2008 and is projected to retain this dubious honour in 2050, too — as the tabulation in Figure 20³⁷ clearly shows:

Country	Rank		Vulnerable Population (Millions)	
	2008	2050	2008	2050
India	1	1	20.6	37.2
Bangladesh	3	2	13.2	27.0
China	2	3	16.2	22.3
Indonesia	4	4	13.0	20.9
Philippines	6	5	6.5	13.6
Nigeria	9	6	4.3	9.7
Vietnam	7	7	5.7	9.5
Japan	5	8	9.8	9.1
USA	10	9	3.8	8.3
Egypt	17	10	2.1	6.3
UK	11	11	3.3	5.6
South Korea	8	12	4.8	5.3
Myanmar	12	13	2.8	4.6
Brazil	14	14	2.6	4.5
Turkey	13	15	2.6	3.9
Malaysia	18	16	1.9	3.5
Germany	15	17	2.3	3.3
Italy	16	18	2.1	2.9
Mozambique	25	19	1.2	2.8
Thailand	19	20	1.8	2.6

Figure: 20

37 David Wheeler. “Quantifying Vulnerability to Climate Change: Implications for Adaptation Assistance”, Center for Global Development, Working Paper 240, January 2011 https://www.cgdev.org/files/1424759_file_Wheeler_Quantifying_Vulnerability_FINAL.pdf

An immediate impact of sea-level rise in areas close to the coast is that of salinization of fresh water. This is schematically depicted in Figure 21³⁸.

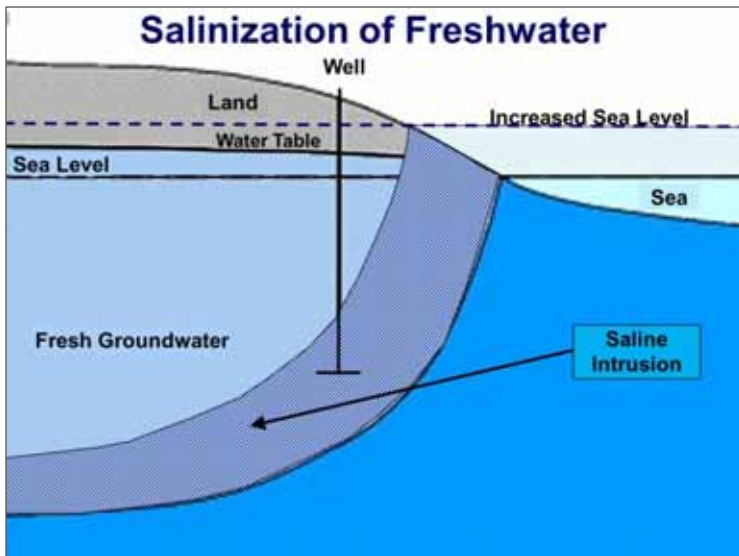


Figure: 21

With the increase in the number of severe cyclones and/or an increase in the intensity of storms in general, an increased number storm-surges is likely. This, combined with a rise in sea level, would result in much higher rates of coastal erosion, which would, in turn, significantly increase saline intrusion. As sea levels rise (for whatever reason), seawater will increasingly be able to overcome natural barriers such as mangroves and move into low lying areas that were hitherto dominated by freshwater. Rising sea levels will also push seawater into coastal fresh water aquifers. While this impact may not be noticed on the surface it could affect groundwater that seeps into estuaries. This will result in the loss of arable land, leading to the migration of coastal populations. This will have both, internal and external ramifications.

38 Image Source (modified by the author): http://www.ozcoasts.gov.au/indicators/saline_intrusion.jsp

Indeed, the linkages between ‘external’ and ‘internal’ threats arising from the impact of climate change are clearly discernible in the maritime space. For instance, the Republic of the Maldives is located a mere 250 nm south-west of India. Its constituent islands and atolls have an average elevation above the current Mean Sea Level of just five feet (the highest elevation is a mere eight feet!). Thus, it is extremely susceptible to a rise in sea levels because of global warming. The 5th Report of the Intergovernmental Panel on Climate Change (IPCC), predicts that in a ‘high emissions’ scenario, there will be a global rise by 52-98 cm (20.47 to 36.22 inches) by the year 2100. This would be disastrous for Maldives — its population is about 336,000 people, many or all of whom could suddenly become ‘boat people’! Where will they all go? Probably to India! Clearly, we need to have multi-dimensional contingency plans in place to deal with the obvious security implications of the unfolding of such a scenario. Such scenarios are unfolding in a number of countries within India’s maritime areas of interest, notably Bangladesh, Indonesia and the Philippines.

An even more intriguing set of totally unexplored issues are thrown up by the loss of arable land in deltaic coastal stretches such as those found in Bangladesh. According to a 2013 report of the World Bank, “40% of productive land is projected to be lost in the southern region of Bangladesh for a 65 cm sea level rise, by the 2080s”³⁹ as a consequence of sea-level rise. In such an eventuality, what will happen to the baselines of Bangladesh, which have currently been drawn up in accordance with the principles set-forth in the 1982 UNCLOS. Will they now lie some 30-40 nm to seaward of the new (receded) coastline? If they are to be adjusted, what will happen to the Exclusive Economic Zone of Bangladesh? How will that adjustment affect India? What will happen to the ruling by the International Tribunal on the Law of the Sea (ITLOS)? Is there a mechanism for ITLOS to revise an earlier ruling? What, indeed, will happen to UNCLOS, which is already facing some robust criticism for the several ambiguities papered over by it and harshly exposed by the imbroglios in the South China Sea and elsewhere? These are questions that have profound security implications and demand the closest attention and detailed scholarship by concerned departments and agencies of the government as

³⁹ World Bank Press Release, 19 June 2013, “Warming Climate to Hit Bangladesh Hard with Sea Level Rise, More Floods and Cyclones”. <http://www.worldbank.org/en/news/press-release/2013/06/19/warming-climate-to-hit-bangladesh-hard-with-sea-level-rise-more-floods-and-cyclones-world-bank-report-says>

well as maritime-domain experts such as India's National Maritime Foundation (NMF) and the Indian Society for International Law (ISIL).

MELTING OF THE POLAR ICE-SHEET

There has been much recent speculation upon the impact upon maritime security of the melting of the Arctic ice-sheet as a function of the potential opening of new routes for maritime trade — what is often called the Northern Sea Route (NSR). The Arctic is warming at twice the rate of anywhere else on earth and paleoclimate data uniformly indicates that the Arctic ice-sheet cannot survive in a world where carbon concentrations exceed their current level (400 ppm). Obviously, much will depend upon technological and political solutions that humans will — or will not — find to reduce emissions. If nothing is done — either politically or technologically — to reduce greenhouse-gas emissions, the resulting ice-melt could well result in an ice-free Arctic Region in the latter half of the present century. The opening of the NSR will certainly affect seaborne trade and International Sea Lanes in the northern 'east-west' reaches of Eurasia, although the effect upon the southern 'east-west' stretch of the Eurasian littoral will be far less. As a consequence, the geopolitical importance of ports such as those in the Koreas and in Japan will significantly increase. Since China has both components of this geography in large measure, it is frantically developing port-infrastructure in its relatively under-developed coast north of the Yangtse River. Such export-oriented northern Chinese ports, catering to shipping along the NSR would save about 25% in transit time — provided they were trading with northern Europe. However, China's trade with northern European countries is minimal — just under 3% of her total international trade. By 2030, only four of China top 20 trade partners are expected to be European countries (Germany, UK, France and the Netherlands). If we take the top ten, only trade with Germany could potentially benefit from a shorter more efficient route through the Arctic. And yet, Asia's big exporters — Japan, South Korea and China — are all planning-for or already investing in ice-capable vessels. So, quite clearly, changes in shipping patterns may be expected over the medium to long term. This has obvious security and war-fighting implications for India and its navy. At the strategic

level, every such new ‘International Sea Lane’ would need to have intermediate ports and shore-based multi-modal transportation infrastructure to provide access to hinterland areas. Only then could the routes become competitive with their more well-established counterparts. Consequently, vigorous Chinese activity to capture and exploit this ‘virgin’ market may be expected. The Belt-and-Road Initiative (BRI) offers important pointers in this regard and lends great urgency to Indian alternative-formulations for pan-regional consolidation structures such as the SAGAR conceptual framework, and, especially, inter-regional connectivity mechanisms such as the International North-South Transit Corridor (INSTC), Project MAUSAM, and the Asia-Africa Growth Corridor (AAGC).

A range of naval mission-impacts, too, result from the aforementioned adverse impacts. Some of these relate distinctly to naval war-fighting capabilities. For instance, the salinity of seawater near the ocean’s surface has changed measurably from 1950 to 2000. This is shown in Figure 22⁴⁰ where the areas in grey are the Earth’s landmasses. Areas in red indicate regions of the sea that have become saltier, while those in blue are sea-regions where water is now less salty. The consequences of this upon submarine and anti-submarine operations are both, obvious and significant.

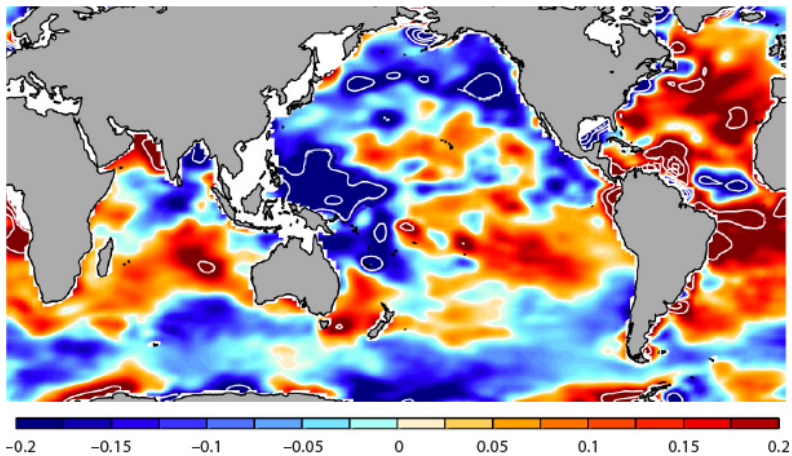


Figure: 22

Climate Change-driven Changes in Ocean Salinity for 1950 to 2000

⁴⁰ Image Source: http://pisaster.genetics.uga.edu/groups/evolution3000/wiki/cb536/Changes_in_Marine_Salinity_Levels.html

Apart from naval combat within conditions of inter-State armed conflict, climate change will significantly strain military transportation resources and supporting force structures in respect of coastal security, antipiracy and counterterrorism, and, as has already been touched upon, HADR missions.⁴¹ In order to mitigate the security impacts of climate change, four of the most critical tasks that need to be urgently undertaken by the Indian Navy are:

- Prepare for increased strain on capabilities due to more frequent and more complex HADR missions
- Address vulnerabilities of naval coastal installations to anticipated sea-level rise and increased storm surges
- Address assessed impacts upon ASW operations and naval force capabilities
- Address heightened regional maritime demands for capacity-building and capability-enhancement in Small Island Developing States of the IOR and the South Pacific, as a function of the IPCC's climate change scenarios

It must never be forgotten that in the developing world, even a relatively small climatic-shift can trigger or exacerbate food shortages, water scarcity, destructive weather events, the spread of disease, human migration, and natural resource competition, and, perhaps most ominous of all, can lead to partial or total 'State-failure'. This is perhaps the most worrying of the several security-related risks inherent in climate-change—and yet, it is a relatively poorly acknowledged one.

'State-failure' is about the whole or partial collapse and internal dissolution of a nation-State. As the former Secretary General of the United Nations, Boutros Boutros Ghali, described it, *"A feature of such conflicts is the collapse of state institutions, especially the police and judiciary, with resulting paralysis of governance, a breakdown of law and order, and general banditry and chaos. Not only are the functions of government suspended, but its assets are destroyed or looted and experienced officials are killed or flee the country."*⁴²

41 John Podesta and Peter Ogden. "The Security Implications of Climate Change". *The Washington Quarterly* (Winter 2007-08), Vol 31:1, pp. 115-138. http://www.dsi.gov.tr/docs/iklim-degisikligi/the_security_implications_of_climatechange.pdf?sfvrsn=2

42 Daniel Thürer. "The 'Failed State' and International Law". Article, *International Review of the Red Cross*, No. 836,31 December 1999. <https://www.icrc.org/eng/resources/documents/article/other/57jq6u.htm>

With some 369 years having elapsed since the Treaty of Westphalia was signed in 1648, 'Conventional Wisdom' is that the current system of sovereign states is reasonably stable. 'Conventional Wisdom' also holds that in assessing climate-change risks emanating from human behaviour, historical experience is an unreliable and inadequate touchstone, since the future is likely to be very different from the past. As with most other nuggets of 'Conventional Wisdom', both tenets stand on shaky foundations. In truth, nation-states are far from being either homogeneous or inherently stable and serious errors would arise if were one to treat them so. History has repeatedly demonstrated that every nation-state suffers substantive and near-continuous internal tensions arising from the aspirations and perceived grievances of the various ethno-religious and socio-economic entities that constitute it. The extent to which the writ of nation-states runs is actually quite limited—certainly in robustness, and often, in geographic terms as well. The resilience of governing-structures in the face of an unexpected and large-scale crisis has frequently been found to be severely wanting. Ad for historical experience, it is true that recorded history cannot readily replicate the cause of a severe crisis—in this case, climate sensitivity that has been brought (by human action and inaction) to the high end of its likely range. However, it certainly can tell us a great deal about the very limited degree to which nation-states are likely to cope. Even recent history demonstrates that the 'capacity' (material wherewithal) and 'capability' (skill or expertise) of counties, cities, towns and suchlike is nowhere near that required to execute a mitigating strategy in the face of sudden collapse of the norms of civic structures. This is so even in economically strong societies such as the USA, as witness the readiness with which civil unrest — resulting from natural causes that are perceived to have been caused or exacerbated by inaction or wrong actions of those 'in authority' — degenerates into looting and the loss of respect for the rights of others. When these 'others' are already disadvantaged in one or another manner, as is often the case in more economically-challenged States, this loss of mutual respect, as also respect for some notionally 'superior' authority, is even more rapid and profound. In the immediate aftermath of Typhoon Haiyan (November 2013), the breakdown of civic society in the Philippines remains a matter of concern. This is not to dismiss

the opposite tendency—of people, when faced with a perceived existential crisis, to cooperate and pull together (as witness the public response during recent floods in Mumbai). It is, however, a stubborn (if uncomfortable) fact that government structures tend to relinquish control rather easily (if not readily) in the face of sudden and massive adverse impacts.

By definition, 'State-failure' is about 'States'. It is by no means certain that even 'enlightened self-interest' will force governments to act in the greater 'common good'. The story of one of the world's youngest nation-states, South Sudan, where hope for a greater economic 'common good' (as represented by its bountiful oil trumping real and perceived injustices of the past vis-à-vis the government in Khartoum) was belied, is a depressing one. Governments, it would appear, can quite readily plump for the option of cutting off their noses to spite their faces. History also shows that the response that most governments have when faced with sudden, traumatic societal impacts is the immediate application of massive physical force, often involving the deployment of paramilitaries and even militaries. Thus, even if one were not to delve further into the specifics of intra-State politics, it is obvious that in terms of climate change, it is eminently possible to assess the risk of state failure by a process of historical reference. In fact, this is probably our only reliable bellwether. Quantification along measures of the scale of people affected versus the scale of the disaster in question is only one of several quantitative techniques that need to be used.

Although a global consensus on what exactly constitutes State-failure continues to elude us, there are a few common characteristics that might be used in assessing the degree to which a State has failed or is failing: (a) A significant inability to provide security to its population resulting from failure to retain a monopoly on the legitimate use of force, (b) An inability to provide and equitably distribute expected goods and services, (c) a serious erosion of the power to make and enforce collective decisions, (d) the involuntary movement of populations including refugees. From a sociological perspective, two features predominate. The first is that the monopoly of power as a basic function of the State is destroyed and the police, judiciary and other bodies serving to maintain law and order have either ceased to exist or are no longer able to operate. In many cases,

they are used for purposes other than those for which they were intended to the point where 'privatization' of the State leads to its criminalization. The second is the brutality and intensity of the violence used following the breakdown of State institutions. There is a radicalization of violence, the irrationality of which stands in stark contrast to politically guided and systematically escalated use of force.

The adverse physical impact of severe climate change fallouts (global temperature crossing 5.5°C pre-industrial levels) is quite likely to lead to State-failure in a number of nation-states—predominantly already seriously economically-challenged ones in Africa, but also in already climatically-challenged areas such as West Asia, and some parts of South and South-East Asia. Take for instance, demographic shifts into India from drought conditions in Afghanistan and, as a consequential domino effect, from Pakistan; from incessant flooding and loss of land territory in Bangladesh. Add to this (a) India's own increasingly evident internal demographic shift (from rural to urban areas and the consequent increase in population density in what are likely to become minimally-governed urban-sprawls), (b) the greatly increased frequency of cyclones and compression of monsoon rains into periodic intense, destructive squalls resulting in the regular inundations of very-high-population-density coastal cities such as Kolkata, Chennai and Mumbai, and (c) the large scale influx of refugees from Bangladesh and Afghanistan-Pakistan. Any such influx would hugely exacerbate the precarious situation prevailing in India's extant 'Red Corridor' — a huge north-south gaping gash of economic deprivation and misgovernance that is even today in turmoil through violent Marxist-Leninism, and which cuts through almost all the eastern states of India, from the porous India-Nepal border right down to Andhra Pradesh and extends westwards into Maharashtra. The Indian State is perceptibly fighting failure in this belt and a further influx of refugees, with their own requirements of economic and political settlement, could possibly even push the country over the tipping point. Once again it may be seen that an adverse global event (climate change) acting upon an external State entity (e.g., Bangladesh and/or Pakistan) can cause a significant reduction of 'internal' security within India.

A variety of models and theories of 'State failure' exist. Some NGOs, such as the Fund for Peace link 'failure' to a lack of democracy. However, this is a

peculiarly western-liberal notion and may not be as globally relevant as its votaries would have people believe. In much of Asia and in Africa, for instance, there is tacit (if not overtly articulated) recognition that it is 'fair and just governance' that matters far more than the form of government. Thus, one finds large 'paper democracies' whose adherence to global norms of elected representation in government are impeccable, but whose governance is poor, as well as large 'authoritarian governments' where governance is far better than traditionally expected, with impressive adaptive and mitigating strategies already in place. The same is true of nominal and real monarchies on both these continents. The actual degree to which governance is and is perceived to be just and fair would appear to matter far more than the form that this governance takes. This should not be confused with apparent adherence to law and order, since that can also be achieved through brutal internal repression by the State. State systems that demonstrate a consistent degree of 'just' and 'fair' governance and strong concern for the present and future wellbeing of their peoples—at a level as close to the individual as possible, are less likely to suffer state-failure.

The fact that several NGOs dealing with the assessment of risks associated with climate change are turning for mitigation not to the nation-state itself but to its smaller constituents: cities and towns, and even smaller groupings lying just above the level of individuals, reflects a tacit but growing recognition of the narrow limits of both, receptivity and resilience, on the part of the nation-state, and hence seeks to execute mitigating strategies at sub-State levels. It is a worrisome thought that these very mitigating strategies might well end-up emphasising narrower interests of specific constituent groups and in the bargain, actually increase the possibility of State failure by emphasising sub-national identities in the face of large scale adverse climatic impacts.

An important quantitative approach in determining the risk of state failure appears to lie in the correlation between economic losses accruing from the adverse impacts of climate change and the 'Real GDP' of a country in terms of both, its absolute value and its growth percentage. In China, for instance, the worst 'direct' percentage-loss of GDP as a result of climate impact is reported to have been 6.28% in 1991. Yet, China did not experience anything like State-

failure. It did, however, compare itself with the global trend in general and with more robust economies such as that of the USA in particular and concluded that “the ratio between losses [caused by weather and climate disasters] and GDP for China is nearly eight times the world average and three times that for the USA....” The moot question is ‘At what percentage value would state-failure occur?’ Clearly, this cannot be answered through a simple multiplication of the world average by some factor in excess of ‘eight’, since the resilience of the economies of different states would be very different. Nevertheless, it does point to a probably useful approach-methodology for risk-assessment, which may now be subjected to statistical analysis.

A very important contributor to the GDPs of large developing economies such as those of India and China is external trade. Today, the ratio of ‘External Merchandise Trade-to-GDP’ (Openness Index) is about 37% for India and 46% for China.⁴³ These are enormous figures and have significant implications. Indeed, with national borders remaining generally impermeable without mutual consent, intercourse between sovereign nation-states in the post-Westphalian global construct most commonly occurs as a function of external trade. External trade has the most profound impact upon politico-economic structures at the sub-national, national and supra-national levels. Exploiting the vulnerability of structures of State governance to trade disruptions has historically been a central part of economic and military strategies amongst adversarial or potentially-adversarial states, even outside of actual belligerency. While the effects of trade disruption are widely recognised as being calamitous in the extreme, it is important to distinguish between ‘cause’ and ‘effect’ and to recognise that no matter what the cause — in the instant case, ‘climate change’ — the effect will be equally deleterious. The bulk of international trade is seaborne and hence any significant disruptions of maritime trade will always have very serious effects. As the adverse impacts of climate change diminish the surpluses of commodities that were earlier being traded on the basis of comparative cost-advantage, trade disruptions will occur. On the one hand, this could lead to severe social unrest in the recipient nation. On the other, it could lead to conflict. Indeed,

⁴³ World Bank Data. <http://databank.worldbank.org/data/reports.aspx?source=2&series=TG.VAL.TOTL.GD.ZS&country>

the manner in which nation-states trade is far more complex than the mandarins of various ministries of commerce in the world would have us believe. There is adequate historical evidence to refute the simplistic argument that nations that trade extensively with one another intrinsically have a lesser chance of entering into conflict than do those whose trade interdependencies are comparatively negligible. There is also no gainsaying the fact that international patterns of bilateral trade create domestic economic-models in each of the countries involved. At a given point in a nation's development and in a given condition of world trade, it might be cheaper for that country to import a commodity (coal, for example) rather than having to develop, at far greater cost, the internal logistic-supply lines and infrastructure to transport the same commodity from its source to its points of consumption. Subsequently, as global geopolitics change, the nation concerned may find itself denied the import it had become reliant upon. Faced with the social, political and fiscal cost of rejigging its economy to now create the requisite internal logistic-supply infrastructure and the social mechanisms that would permit the internal transportation of the commodity, the nation concerned may well find it cheaper and more expedient to simply threaten the import-source with conflict or even to actually go to war. Once again, should the underlying cause of stoppage of import be driven by climate change, the end result might well be the same.

At what point would such denials and deprivations result in a degree of social unrest that would lead to State-failure? At which point, for example, does the loss of fish-catch revenue lead an increasingly desperate population to take to piracy as a means of economic livelihood, as in the case of Somalia? Once again, a statistical correlation between a severe deprivation and the consequent percentage of loss of GDP might offer quantitative answers that are amenable to extrapolation.

Finally, the fact that several NGOs dealing with the assessment of risks associated with climate change are turning for mitigation not to the nation-state itself but to its smaller constituents: cities and towns, and even smaller groupings lying just above the level of individuals, reflects a tacit but growing recognition of the narrow limits of both, receptivity and resilience, on the part of the nation-state, and hence seeks to execute mitigating strategies at sub-State levels. It is a worrisome thought that these very mitigating strategies might well end-up

emphasising narrower interests of specific constituent groups and in the bargain, actually increase the possibility of State failure by emphasising sub-national identities in the face of large scale adverse climatic impacts.

RECOMMENDATIONS

With all these grim facts having been hoisted, it is pertinent to at least highlight a few policy-recommendations that the Government of India would do well to carefully consider. While it is intended to dilate upon these in greater detail in a subsequent monograph, the following listing may, in and of itself, prove useful:

- **Spread Awareness amongst Governmental Echelons:** The ‘brains-trust’ of the Government of India is a robust and invaluable resource and is to be ubiquitously found across ministries, departments and allied governmental-structures. However, most governmental echelons are beset with innumerable challenges germane to the day-to-day minutiae of their departments and/or ministries, and have had little or no opportunity to even become sufficiently aware of the security-implications of climate change. An institutional, whole-of-government thrust at creating awareness — concurrently at the levels of the central and state governments — is, therefore, a sine-qua-non for the formulation of mitigating and adaptive strategies against these adverse impacts.
- **Involve Multiple Stakeholders:** Governmental echelons are not the sole source of the originality and innovation required to determine optimal mitigating and adaptive strategies. In fact, governments are not particularly well-known for either originality or innovation. It is, therefore, very important to widen the input-base by involving as many stakeholders as possible. It is particularly important to capitalise upon the idealism, exuberance and commitment of the country’s youth and, in particular, the female population amongst them. A number of organisations exist, both within and outside government, that could coordinate and superintend this widening of the base of stakeholders — the Ananta Centre is itself a leading one amongst these.

- **Commission Focussed Studies:** India is fortunate to have specialised think-tanks that are sharply focussed upon the maritime domain. Think-tanks such as the National Maritime Foundation (NMF) are founded upon the recognition that the term 'maritime' is far more than merely the 'Navy-Coast Guard' amalgam and that the term 'security' is far more than 'military security' alone. Government could — and should — commission a series of focussed studies that would formulate specific preventive, curative, mitigating and adaptive strategies to deal with the impact of climate change upon maritime security. Likewise, the IDSA, CLAWS and the USI are well-placed to produce similar focussed-outputs relevant to the impact of climate change upon holistic land-based security.
- **Vigorously Involve the Private Sector:** India's private sector has deep stakes in adaptive and mitigating strategies designed to protect the investments made by it in national development. There are clearly business opportunities in each preventive, curative, mitigating and adaptive strategy. There is also much that be gained from harnessing the carefully developed efficiencies that exist within the private sector.
- **'Brand-position' Climate-Change in the India's Collective Consciousness:** Without correct 'branding', the disruptive and adverse impacts of climate change upon the day-to-day lives of the citizenry will not garner the requisite public (and hence 'political') support. This is not something that can be sustained by a generalist approach by one or more governmental echelon/structure. It is a specialised task that requires a well-planned publicity and information-plan and is, therefore, best done by a specialised branding company/agglomerate.
- **Create a 'Climate-Change-and-Security Contingency Planning Group':** The Government needs an inter-ministerial group — perhaps under the rubric of the NITI Aayog, or the EAC to the PMO, or the NDMA (National Disaster-Management Authority) — to evolve contingency-based coping-and-adaptive strategies, plans, and responses to the security-impacts of climate change that have been touched-upon in the foregoing sections.
- **Vigorously Pursue the Proliferation of OTEC:** Given the high capital and

running expenses of Reverse Osmosis (RO) OTEC (Ocean Thermal Energy Conversion) offers a highly viable solution to water-stress in India's Lakshadweep and A & N Island chains, as also in specific areas along the country's East Coast. The proliferation of OTEC plants lends itself admirably to capacity-building at a pan-regional level, most especially in water-stressed Small and Developing Island States (SIDS) of the IOR and, as such must be incorporated as a major thrust line within Indian geopolitical strategy, under the rubric of SAGAR and IORA.

- **Build Adaptive and Coping Infrastructure in SIDS throughout the Indo-Pacific:** Heightened regional maritime demands for capacity-building and capability-enhancement in Small Island Developing States of the IOR and the South Pacific, as a function of the IPCC's climate change scenarios, offer an excellent opportunity for India to underscore its position as a net security-provider with particular emphasis on non-traditional security.
- **Build Adaptive and Coping Infrastructure against GLOF-Events in Nepal:** The positive spin-offs of manifestations of Indian resolve in Nepal by way of coping and adaptive strategies against GLOF (Glacial Lake Outburst Flood) events are likely to be disproportionately large. If this is supported by a strong brand-building exercise, it would greatly help in countering the growing influence of China in Nepal.
- **Tasking of the Indian Navy:** Task the Indian Navy to draw-up and submit to the PMO:
 - Its plans to meet the increased strain on its 'capacity' as well as its 'capabilities' due to the strong likelihood more frequent and more complex HADR missions, at both, an independent level as well as at the level of the Indian Ocean Naval Symposium (IONS)
 - A vulnerability-assessment and mitigation-options in respect of naval coastal installations in the face of anticipated sea-level rise and increased storm-surges
 - A detailed assessment of the salinity-changes and the impact of these changes upon ASW surveillance operations (especially vis-à-vis Chinese nuclear submarines), as also naval force-capabilities.

CONCLUSION

The foregoing arguments represent yet another attempt by this author to highlight the very substantial and substantive impact that climate change has (and will continue to have with increasing intensity and scope) upon national as well as regional security. The monograph draws upon my earlier work on this subject and is intended to reinforce those concepts, cautions and recommendation that have been articulated in other writings of mine as well as those of other scholars. With every passing day the urgency of action to be taken by India in mitigating the adverse security-impacts of climate change becomes more acute. We are rapidly approaching the point where our coping and adaptive strategies to ensure holistic security for our people will fall under the category of “too-little-too-late”. This is not something that a resurgent India can afford.





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